

Foot wound risk and quality of life of people with type 2 diabetes are related to self-care

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ABSTRACT

Introduction: Adherence to self-care has been identified as a means of preventing diabetic foot wounds, positively influencing the clinical outcomes and quality of life of patients. The adherence to this strategy is divergent in different populations. It is essential to determine the self-care practices that are associated with diabetic foot ulcers and the quality of life in adults with diabetes. **Objective:** To understand self-care practices and explore their relationship with the foot wound risk and quality of life of persons with type 2 diabetes in a city in northeastern Brazil. **Methods:** A descriptive exploratory study was conducted with a sample of 300 individuals with type 2 diabetes. Data were collected using a sociodemographic questionnaire, classification of foot wound risk, the Summary of Diabetes Self-Care Activities, and SF-36. **Results:** Adherence to self-care was low for physical exercise, self-monitoring of blood glucose, and foot care. The diet and the use of medication had better adherence by the participants. Foot wound risk was related to no adherence to diet (OR 2.2 95% CI 1.32-3.38), physical activity (OR 0.49 95% CI 0.25-0.95), and blood glucose checking (OR 5.31 95% CI 1.58-17.78). Quality of life was associated with physical activity (OR 0.35 95% CI 0.16-0.74). **Conclusion:** It can be concluded that is a relationship between self-care practices adherence, risk of foot wounds, and quality of life.

Keywords: Diabetes Mellitus; diabetic foot; self-care; Quality of life; diabetes complications.

INTRODUCTION

Diabetes mellitus (DM) is a disease of global concern, with high rates of morbidity, mortality, and a high prevalence of complications, especially diabetic foot ulcer^{1,2}. The incidence of this complication reaches 30% and after the first ulcer, the risk of recurrence varies between 40% in the first year and up to 65% in five years². The worldwide estimate is that every 30 seconds, there is an amputation of the foot or part of the lower limb due to diabetic foot ulcers, in addition to being related to high mortality, with rates close to 40%³. The annual expenditure on the treatment of diabetic foot ulcers in Brazil reaches US\$ 55.708.686⁴.

How to cite this article: Rocha et al. Foot wound risk and quality of life of people with type 2 diabetes are related to self-care. ABCS Health Sci. 2023;48:e023209 <https://doi.org/10.7322/abcshs.2021056.1789>

Received: Mar 17, 2021

Revised: Jul 07, 2021

Approved: Jul 22, 2021

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Declaration of interest: nothing to declare



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Self-care, the care actions performed for their benefit⁵, has been identified as a strategy for preventing and controlling complications in people with DM because it facilitates glycemic control^{6,7}. Diet, physical activity, foot care, self-monitoring of blood glucose, and medication use are key DM self-care behaviours⁶. In Brazil, self-care support is offered in primary care, in which nurses and community health agents act as the main care coordinators^{8,9}. The nurse is the main professional in interventions combined with education for self-care in the DM population⁸. Community health agents are essential for the care of these patients, as they inform the team about health needs and monitor adherence to self-care⁹. Adherence in healthcare can be defined as the acceptance and fulfillment of the guidelines of health professionals¹⁰.

Few studies investigated the relationship between self-care and foot wound risk¹¹. Self-care has been identified as a means of preventing diabetic foot ulcers, and positively influencing the clinical and quality of life (QoL) outcomes of patients^{6,7,11}. There are several concepts for QoL, in general; it is multidimensional and linked to the way the person perceives his life in different contexts, about his perceptions, objectives, and beliefs¹². DM and its related complications lead to a reduction in QoL as it generates disabilities resulting from complications such as diabetic foot ulcer¹³. The study by Al Sadrah et al.¹⁴ demonstrated lower QoL in patients with diabetic foot ulcers, as well as the discriminative ability, between having or not having this complication, on the SF-36 scale.

Measuring QoL levels is a way of evaluating the results of DM self-care since the best QoL is associated with practices such as self-care¹⁵. Babazadeh et al.¹⁶ in a study carried out with 120 participants with type 2 DM, demonstrated an association between adherence to self-care behaviors and better QoL. The study by Mariam et al.¹⁷ found that people with DM who were not adhering to self-care were 2.52 times more likely to develop a diabetic foot ulcer. The results regarding adherence to this strategy are divergent, considering that the self-care components have different adherence rates according to the clinical and sociodemographic characteristics of the studied population and the instrument used to verify adherence¹⁸⁻²⁰.

Marinho et al.²⁰ demonstrated in their cohort study of 472 patients with Type 2 DM that the participants showed greater adherence to the use of medication, foot care, and self-monitoring of blood glucose, than the practices of physical activity and diet. These patients' adherence was different from the results presented in the prospective observational study of 295 adults with Type 2 DM by Ausili et al.¹⁹, in which participants were more adherent to diet and self-monitoring of blood glucose, with lower adherence to foot care and physical activity. The divergent results between the two studies may be related to the interference of the clinical characteristics of the individuals at

the time of the research, the first study had a higher percentage of complications in volunteers.

Taking into account the importance of self-care in preventing complications and improving QoL, and the divergent findings related to self-care in different populations, it is essential to determine the self-care practices that are associated with diabetic foot ulcers and QoL in adults with DM. Moreover, this enhanced knowledge could inform measures to enhance patient adherence to self-care. Our hypothesis is that adherence to self-care is related to QoL and foot risk of wounds.

Thus, the present study aims to understand self-care practices and explore their relationship with the foot wound risk and QoL of individuals with type 2 diabetes in a city in northeastern Brazil so can be proposed measures to control and reduce complications.

METHODS

Study type

This is an exploratory descriptive study carried out in 6 primary care health units and 2 centers of medical specialties in a single municipality in northeastern Brazil. The study was carried out from July 2018 to August 2019, with the approval of the local research ethics committee (process 2,689,629).

Sample

The sample included 300 persons with type 2 DM over 18 years of age. Potential participants were excluded if they had: (a) gestational diabetes or (b) type 1 DM. The target sample size was determined using the RaoSoft[®] online calculator, based on the most recent data from the Primary Care Information System on the number of people with DM in the city. Taking into account a margin of error of 5% and a level of confidence of 90%, a level of heterogeneity of 50%, resulting in a sample of 300 participants. All participants signed an informed consent form.

The participants were recruited in the waiting rooms of the specialty centers and the primary care units. The diagnosis of DM was confirmed through medical records or the Community Health Agent follow-up form.

Data collection

The data were collected through the application of questionnaires and physical evaluation. The evaluations were performed by a single previously trained physiotherapist. The sociodemographic and clinical data of DM were collected through a questionnaire created by the researchers, including sex, education, smoking history, duration of DM, medications, comorbidities, and BMI verification.

The International Working Group on the Diabetic Foot (IWGDF) instrument²¹ was used to classify the foot wound risk,

in which it considered: risk 0 (no loss of protective sensation); risk 1 (loss of protective sensation); risk 2 (loss of protective sensation with deformities); and risk 3 (loss of protective sensation with a history of ulcer and/or amputation or end-stage renal disease).

The classification of patients according to the IWGDF was composed of the neurological evaluation carried out with the verification of the vibratory perception in the hallux with 128hz tuning fork; reflex test (Achilles); and superficial sensitivity with 10g Semmes-Weinstein monofilament. The absence or reduction of sensitivity through the tuning fork or monofilament was considered for the loss of protective sensation. The feet were inspected for deformities and wounds.

Self-care was measured using the Summary of Diabetes Self-Care Activities¹⁸. This summary consists of 15 items divided into 5 categories: diet, physical activity, self-monitoring of blood glucose, foot care, and medication. The items are given scores from 0 to 7, indicating the number of days that the participant performed the activity in the last week. The best performance of self-care is represented by the highest scores in each item: 7 days a week for diet and medication adherence²²; Adherence to self-monitoring of blood glucose, physical activity, and care with feet will be considered optimal ≥ 5 days a week²⁰.

QoL was measured using the SF-36 questionnaire, which is structured into 36 questions covering 8 components: functional capacity, physical aspects, pain, general health, vitality, mental health, social, and emotional aspects. Each domain is scored from 0 (worst result) to 100 (best result)¹⁴.

Statistical analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences software, version 21 (IBM Corp., Armonk, NY). Patient medical records were accessed when were identified as missing sociodemographic and clinical data. Descriptive statistics were summarized by absolute numbers and percentages. Continuous data were presented using the mean and standard deviation (SD). Differences in self-care means between sociodemographic variables were determined using the t-test and One-Way Anova. The Tukey and Games-Howell post hoc tests were used for within-group comparisons. The association between self-care, QoL, and wound risk was determined through binary logistic regression.

RESULTS

The study involved 300 participants, of which 62.6% were female and with a mean age of 62.1 (12.4) years. Most of the sample did not receive a formal education or had some elementary school education and had DM for less than 10 years. Table 1 shows the sociodemographic, clinical characteristics, and self-care adherence of the participants in this study.

The highest adherence to the diet was observed in people who use insulin or who have some level of amputation. Men showed greater adherence to physical activity. Adherence to self-monitoring of blood glucose was higher in people over 10 years with DM, amputees, or those who use insulin. Foot care was more practiced by people with amputation or higher education. Medication adherence was higher in people who use insulin and in those with a BMI ≥ 25 kg/m². The self-care adherence was low for physical activity, self-monitoring of blood glucose, and foot care. The diet and the use of medication showed a better average adherence by the participants. The average number of days of the week and the number of people who adhered to each domain of self-care are shown in Table 2.

According to the IWGDF classification of foot wound risk, 85 (28.3%) participants were not at risk for foot wounds, and 215 (71.7%) were at risk 1-3. A binary logistic regression was performed to verify whether no adherence to self-care is a predictor for wound risk. A significant relationship was found between no adherence to diet, physical activity, and blood glucose monitoring, demonstrating that people who do not adhere to these components are more likely to belong to the group that presents some wound foot risk. Table 3 shows the relationship between foot wound risk and self-care.

The QoL of the participants had lower scores in the domains; general health status 52.6 (22.5), functional capacity 54.2 (37.7), and limitation due to physical aspects 58.6 (48.2) when compared to other domains such as vitality 67.8 (27.8), pain 69.0 (30.2), mental health 72.0 (24.4), limitations due to social aspects 85.6 (23,7) and limitation due to emotional aspects 86.7 (33.5). Considering all aspects, the average QoL of the participants was 68.3 (19.2). For the correlation between QoL and self-care, patients were dichotomized into below-average (129 participants) and above-average (171 participants). A significant relationship was found between adherence to physical activity, showing that people who practice physical activity are more likely to belong to the group with the best QoL. Table 4 shows the relationship between the QoL and self-care.

DISCUSSION

This study explored the relationship between self-care, QoL, and foot wound risk. The results showed low adherence of the studied population to self-care. The relation between the foot wound risk with diet, physical activity practice, and self-monitoring of blood glucose, as well as that of QoL with the practice of physical activity, were found, confirming our hypothesis of the relationship between self-care, QoL, and risk of foot wounds in people with DM. The participants in this study demonstrated that they did not have the daily habit of performing self-care activities, they practice more self-care with the progression of DM or as a way

Table 1: Sociodemographic, clinical characteristics of the participants and self-care adherence

Variable	N (%)	Self-care				
		Diet	Physical activity	Self-monitoring of blood glucose	Foot care	Medication
Sex						
Female	188 (62.6)	4.1 (3.3)	1.0 (2.0)	1.2 (2.1)	3.0 (2.9)	6.1 (2.1)
Male	112 (37.4)	4.0 (3.3)	1.67 (2.7)	1.4 (2.3)	3.2 (2.9)	6.1 (2.2)
		P: 0.705	P: 0.019	P: 0.417	P: 0.483	P: 0.882
Literacy						
No formal education	58 (19.4)	4.5 (3.3)	0.7 (1.8)	1.1 (2.2)	2.4 (3.1) ^b	6.0 (2.3)
Elementary school	184 (61.3)	3.9 (3.3)	1.3 (3.4)	1.1 (2.1)	3.0 (2.9)	6.1 (2.2)
High school or Higher education	58 (19.3)	4.3 (3.2)	1.2 (2.3)	1.6 (2.4)	3.8 (2.9)	6.4 (1.8)
		P: 0.402	P: 0.104	P: 0.351	P: 0.042	P: 0.549
BMI (kg/m²)						
<24,9	112 (37.5)	4.4 (3.2)	0.9 (2.1)	1.4 (2.3)	3,2 (3.0)	5.8 (2.5)
≥ 5	188 (62.5)	3.9 (3.3)	1.3 (2.4)	1.1 (2.1)	3,0 (2.0)	6.3 (1.9)
		P: 0.173	P: 0.158	P: 0.436	P: 0.521	P: 0.033
Duration of DM						
0-5 years	213 (71)	4.0 (3.3)	1.3 (2.3)	0.8 (1.8)	2.9 (2.9)	5.9 (2.3)
>10 years	87 (29)	4.2 (3.3)	1.1 (2.2)	1.8 (2.6)	3.2 (3.0)	6.3 (1.9)
		P: 0.487	P: 0.468	P: <0.001	P: 0.428	P: 0.128
Medication						
OHA	207 (68.7)	3.8 (3.3) ^c	1.3 (2.3)	0.7 (1.6) ^c	2.9 (2.9)	6.3 (1.9) ^d
Insulin or OHA + Insulin	76 (25.7)	4.9 (3.0)	0.8 (1.9)	2.7 (3.0) ^d	3.5 (3.0)	6.6 (1.5) ^d
No medication	17 (5.6)	4.2 (3.3)	1.8 (2.8)	1.2 (2.2)	2.9 (2.8)	0
		P: 0.047	P: 0.159	P: <0.001	P: 0.268	P: <0.001
Amputation	32 (10.6)	5.1 (2.9)	1.0 (2.2)	2.8 (2.9)	4.2 (3.1)	6.5 (1.7)
No amputation	268 (89.4)	3.9 (3.3)	1.2 (2.3)	1.0 (2.0)	2.9 (2.9)	6.1 (2.2)
		P: 0.047	P: 0.558	P: 0.002	P: 0.021	P: 0.185
Active wounds	52 (17.3)	2.3 (3.3)	2.2 (3.0)	0.1 (0.3)	3.4 (3.4)	6.2 (2.2)
No Active wounds	248 (82.7)	3.1 (3.4)	3.0 (3.4)	0.3 (0.8)	3.3 (2.8)	6.5 (1.8)
		P: 0.517	P: 0.522	P: 0.303	P: 0.906	P: 0.742

BMI, body mass index; OHA, oral hypoglycemic agents; Bold represents the significant p-values. ^amean (SD) (adherence is defined by days/week of adherence); ^bSignificant difference compared to the group with high school or higher; ^cSignificant difference compared to the insulin group; ^dSignificant difference compared to the non-medication group

Table 2: Self-care score and adherence

Self-Care	Mean (SD)	Self-Care AdherenceN (%)
Diet	4.12 (3.3)	162 (54)
Physical activity	1.16 (2.2)	41 (13.6)
Self-monitoring of blood glucose	1.27 (2.2)	38 (12.6)
Foot care	3.12 (3.4)	50 (16.6)
Medication	6.16 (2.2)	259 (86.3)

SD, Standard deviation; OHA, oral hypoglycemic agents
Adherence is defined by days/week of adherence

to treat complications when present, using self-care as a form of treatment and not in prevention.

Low adherence to self-care also occurs in other countries, a cross-sectional study with 302 participants from Italy showed

low adherence averages on weekdays for diet 5.0 (0.1), physical activity 2.5 (0.2), self-monitoring of glucose 3.9 (0.3) and care for the feet 3.1 (0.3)¹⁹. The same occurs in other regions of Brazil, in São Paulo, a cross-sectional study conducted with 218

Table 3: Binary logistic regression of self-care and foot wound risk

Self-care	No riskN (%) ^a	wound riskN (%) ^a	Odds Ratio (95% CI)	p
Diet	51 (60)	87 (40.4)	2.20 (1.32-3.68)	0.002
Physical activity	67 (78.8)	190 (88.3)	0.49 (0.25-0.95)	0.036
Self-monitoring of blood glucose	82 (96.4)	180 (83.7)	5.31 (1.58-17.78)	0.007
Foot care	50 (58.8)	116 (53.9)	1.21 (0.73-2.02)	0.445
Medication	11 (12.9)	30 (13.9)	0.91 (0.43-1.92)	0.818

Binary logistic regression considering people without foot wound risk (R0) and foot wound risk (R1 to R3) as dependent variables and self-care as a variable of interest. ^a No adherence rates. Bold represents the significant p-values.

Table 4: Binary logistic regression of self-care and QoL

Self-care	QOL Below the mean N (%) ^a	QOL Above the mean N (%) ^a	Odds Ratio (95% CI)	p
Diet	69 (53.4)	93 (54.3)	0.95 (0.61-1.52)	0.877
Physical activity	10 (7.7)	33 (19.2)	0.35 (0.16-0.74)	0.006
Self-monitoring of blood glucose	8 (13.9)	20 (11.6)	1.22 (0.61-2.42)	0.561
Foot care	57 (44.1)	77 (45)	0.96 (0.61-1.53)	0.844
Medication	110 (85.2)	149 (87.1)	0.85 (0.44-1.65)	0.642

Binary logistic regression considers people below and above-average overall QoL as dependent variables and self-care as a variable of interest. ^a Adherence rate. Bold represents the significant p-values

participants with type 2 DM reported average adherence to diet 5.0 (2.5), physical activity 2.4 (2.7), self-monitoring of glucose 4.5 (2.8) and care for the feet 4.5 (3.1)²³. The different versions of the self-care assessment instrument used by the articles may have interfered with the results reported by the studies. However, the adherence means to self-care in the present study are lower than those reported by these authors. Some hypotheses can be raised to justify their behavior.

Patients' lack of knowledge regarding self-care could be one of the factors that caused low adherence. This might be related to the low educational level of the sample and the lower performance and valuation of educational activities by the health services implemented in the city where the present study was carried out. It was found that 74.6% of the participants in this study have a level of education up to a maximum of elementary school. When comparing our results with a study carried out in Ethiopia, it is possible to emphasize the importance of educational level and health education for greater adherence to self-care²⁴. Approximately 59.5% of the population had at most elementary school and 45.7% received education on DM which reflected in better adherence to self-care, with a higher rate of adherence to physical activity, use of medication, and foot care when compared to this study.

The education level of the population is one of the main challenges in carrying out educational programs by health professionals, who must seek simple and effective strategies for the transmission of knowledge²⁵. There are several strategies for educational activities to be carried out and the literature demonstrates their positive

role in adhering to self-care²⁶. A systematic review including 120 articles that addressed educational activities on self-care in people with DM demonstrated improvement in glycemic control in 61.9% of studies²⁷. Therefore, these activities still constitute the main means to avoid or minimize the impact of the disease²⁸.

No adherence to diet, the practice of physical activity, and checking blood glucose levels were related to a foot wound risk, demonstrating the importance of self-care for the prevention of this complication. However, the curative model seems to predominate as a care strategy in the studied population. Greater adherence to different aspects of self-care was identified in the presence of amputation, wounds, use of insulin, and lasting more than 10 years from diagnosis, indicating that people only perform self-care in the presence of comorbidity, focusing care on treating diseases. The same behavior was demonstrated in the cross-sectional study in a Chinese patient with type 2 DM who found an association between the perception of the disease and future risk with self-care²⁸.

The practice of physical activity was correlated with QoL, as the participants who showed greater adherence to physical activity were more likely to have a higher QoL index. Physical activity seems to be one of the strategies with the best results in this study since it was related to both the risk of wounds and QoL. Studies confirm the relationship between adherence to physical activity and the prevention of complications related to DM^{29,30}. The practice of physical activity promotes disease control and avoids complications by decreasing insulin resistance and contributing to glycemic control³⁰. Therefore, the implementation of measures

that encourage self-care, mainly related to physical activity, can improve the QOL of patients with DM²¹.

However, in the present study, the participant's adherence to physical activity was 1.16 (2.2) days. Thomas et al.³¹ demonstrated that the main barrier to performing physical activity in Scottish patients with DM is the lack of confidence in their ability to exercise. This may be one of the factors that have also contributed to the low adherence of the participants in this study to physical activity since they had low scores in functional capacity and limitations due to physical aspects on the QOL scale. The lack of public physical activity programs aimed at the population in Brazil may be another factor that contributes to low adherence. The study by Ferreira et al.³² conducted in Brazil demonstrated that only 20% of the participants knew about a public physical activity program.

The realization of self-care differs according to the population studied, thus, it is relevant to know the factors related to this, as it allows better guidance and planning of activities by health professionals. The study proposes the implementation of educational measures, taking into account the level of education of individuals and that can encourage adherence to self-care practices. These can be structured collectively or individually so that the guidelines are focused on the individual needs of patients. The implementation of physical activity groups and/or the guidelines for carrying out this should be encouraged, given the relationship with QoL and the reduction of complications demonstrated by other studies as well.

There are also some limitations to our study. 1- It presents the limitations inherent in observational studies such as the impossibility of interpreting the causal relationship between the variables; 2- The results related to QoL and self-care were dependent on the participants' report, which can cause memory bias, once this occurs, our results may not portray the real situation of this population. 3- To measure QOL, the SF-36 instrument, not specific to DM, was used, which may not measure the specific challenges faced by people with DM. One of the strengths of our study is the fact that the participants had characteristics representative of the average of people with DM in the community and they were recruited through random sampling, which allows the generalization of results and contributes to the knowledge and implications for self-care for people with DM. For future research, we recommend conducting studies with other designs to explore the cause and effect of self-care, wound foot risk, and QoL. This study is one of the only ones that investigate the relationship between self-care and the risk of injuries in the Brazilian population. It is hoped that this will be a stimulus to carry out more research aimed at this topic in different regions of the country so that the results can be compared and new health policies are produced based on these comparisons.

ACKNOWLEDGMENTS

The authors would like to express their gratitude to the City Hall of Parnaíba and the Health Secretariat of the State of Piauí for their support of the study.

REFERENCES

- Li S, Wang J, Zhang B, Li X, Liu Y. Diabetes Mellitus and Cause-Specific Mortality: A Population-Based Study. *Diabetes Metab J*. 2019;43(3):319-41. <https://doi.org/10.4093/dmj.2018.0060>
- Armstrong DG, Boulton AJM, Bus SA. Diabetic foot ulcers and their recurrence. *N Engl J Med*. 2017;376(24):2367-75. <http://doi.org/10.1056/NEJMra1615439>
- Chammas NK, Hill RL, Edmonds ME. Increased Mortality in Diabetic Foot Ulcer Patients: The Significance of Ulcer Type. *J Diabetes Res*. 2016;2016:2879809. <http://doi.org/10.1155/2016/2879809>
- Toscano CM, Sugita TH, Rosa MQM, Pedrosa HC, Rosa RDS, Bahia LR. Annual Direct Medical Costs of Diabetic Foot Disease in Brazil: a Cost of Illness Study. *Int J Environ Res Public Health*. 2018;15(1):89. <http://doi.org/10.3390/ijerph15010089>
- Borba AKOT, Arruda IKG, Marques APO, Leal MCC, Diniz ADS. Knowledge and attitude about diabetes self-care of older adults in primary health care. *Cienc Saude Coletiva*. 2019;24(1):125-36. <https://doi.org/10.1590/1413-81232018241.35052016>
- Kim EJ, Han KS. Factors related to self-care behaviours among patients with diabetic foot ulcers. *J Clin Nurs*. 2020;29(9-10):1712-22. <http://doi.org/10.1111/jocn.15215>
- Moghadam ST, Najafi SS, Yektatalab S. The Effect of Self-Care Education on Emotional Intelligence and HbA1c level in Patients with Type 2 Diabetes Mellitus: A Randomized Controlled Clinical Trial. *Int J Community Based Nurs Midwifery*. 2018;6(1):39-46.
- Batista IB, Pascoal LM, Gontijo PVC, Brito PS, Sousa MA, Santos Neto M, et al. Association between knowledge and adherence to foot self-care practices performed by diabetics. *Rev Bras Enferm*. 2020;73(5):e20190430. <https://doi.org/10.1590/0034-7167-2019-0430>
- Ribeiro SA, Moreira AD, Reis JS, Soares AN, Géa-Horta T. Elaboration and validation of a booklet on diabetes for Community Health Workers. *Rev Bras Enferm*. 2020;73(4):e20180899. <https://doi.org/10.1590/0034-7167-2018-0899>
- Tavares NUL, Bertoldi AD, Mengue SS, Arrais PSD, Luiza VL, Oliveira MA. Factors associated with low adherence to medicine treatment for chronic diseases in Brazil. *Rev Saude Publica*. 2016;50(suppl 2):10s. <https://doi.org/10.1590/S1518-8787.2016050006150>
- Goodall RJ, Ellauzi J, Tan MKH, Onida S, Davies AH, Shalhoub J. A Systematic Review of the Impact of Foot Care Education on Self Efficacy and Self Care in Patients With Diabetes. *Eur J Vasc Endovasc Surg*. 2020;60(2):282-92. <https://doi.org/10.1016/j.ejvs.2020.03.053>

12. Study protocol for the World Health Organization project to develop a Quality of Life assessment instrument (WHOQOL). *Qual Life Res.* 1993;2(2):153-9.
13. Polikandrioti M, Vasilopoulos G, Koutelekos I, Panoutsopoulos G, Gerogianni G, Babatsikou F, et al. Quality of Life in Diabetic Foot Ulcer: Associated Factors and the Impact of Anxiety/Depression and Adherence to Self-Care. *Int J Low Extrem Wounds.* 2020;19(2):165-79. <https://doi.org/10.1177/1534734619900415>
14. Al Sadrah SA. Impaired quality of life and diabetic foot disease in Saudi patients with type 2 diabetes: A cross-sectional analysis. *SAGE Open Med.* 2019;7:2050312119832092. <https://doi.org/10.1177/2050312119832092>
15. Tran BX, Nguyen LH, Pham NM, Vu HTT, Nguyen HT, Phan DH, et al. Global Mapping of Interventions to Improve Quality of Life of People with Diabetes in 1990-2018. *Int J Environ Res Public Health.* 2020;17(5):1597. <https://doi.org/10.3390/ijerph17051597>
16. Babazadeh T, Dianatinasab M, Daemi A, Nikbakht HA, Moradi F, Ghaffari-Fam S. Association of Self-Care Behaviors and Quality of Life among Patients with Type 2 Diabetes Mellitus: Chaldoran County, Iran. *Diabetes Metab J.* 2017;41(6):449-56. <https://doi.org/10.4093/dmj.2017.41.6.449>
17. Mariam TG, Alemayehu A, Tesfaye E, Mequannt W, Temesgen K, Yetwale F, et al. Prevalence of Diabetic Foot Ulcer and Associated Factors among Adult Diabetic Patients Who Attend the Diabetic Follow-Up Clinic at the University of Gondar Referral Hospital, North West Ethiopia, 2016: Institutional-Based Cross-Sectional Study. *J Diabetes Res.* 2017;2017:2879249. <https://doi.org/10.1155/2017/2879249>
18. Michels MJ, Coral MHC, Sakae TM, Damas TB, Furlanetto LM. Questionnaire of Diabetes Self-Care Activities: translation, cross-cultural adaptation and evaluation of psychometric properties. *Arq Bras Endocrinol Metab.* 2010;54(7):644-51. <https://doi.org/10.1590/S0004-27302010000700009>
19. Ausili D, Bulgheroni M, Ballatore P, Specchia C, Ajdini A, Bezze S, et al. Self-care, quality of life and clinical outcomes of type 2 diabetes patients: an observational cross-sectional study. *Acta Diabetol.* 2017;54(11):1001-8. <https://doi.org/10.1007/s00592-017-1035-5>
20. Marinho FS, Moram CBM, Rodrigues PC, Leite NC, Salles GF, Cardoso CRL. Treatment Adherence and Its Associated Factors in Patients with Type 2 Diabetes: Results from the Rio de Janeiro Type 2 Diabetes Cohort Study. *J Diabetes Res.* 2018. <https://doi.org/10.1155/2018/8970196>
21. Schaper NC, van Netten JJ, Apelqvist J, Bus SA, Hinchliffe RJ, Lipskyet BA, et al. Practical Guidelines on the prevention and management of diabetic foot disease (IWGDF 2019 update). *Diabetes Metab Res Rev.* 2020;36(Suppl 1):e3266. <https://doi.org/10.1002/dmrr.3266>
22. Dasappa H, Prasad S, Sirisha M, Ratna Prasanna SVN, Naik S. Prevalence of self-care practices and assessment of their sociodemographic risk factors among diabetes in the urban slums of Bengaluru. *J Family Med Prim Care.* 2017;6(2):218-21. <https://doi.org/10.4103/2249-4863.220037>
23. Coelho ACM, Boas LCGV, Gomides DS, Foss-Freitas MC, Pace AE. Self-care activities and their relationship to metabolic and clinical control of people with diabetes Mellitus. *Texto Contexto Enferm.* 2015;24(3):697-705. <http://dx.doi.org/10.1590/0104-07072015000660014>
24. Getie A, Geda B, Alemayhu T, Bante A, Aschalew Z, Wassihun B. Self-care practices and associated factors among adult diabetic patients in public hospitals of Dire Dawa administration, Eastern Ethiopia. *BMC Public Health.* 2020;20:1232. <https://doi.org/10.1186/s12889-020-09338-5>
25. Rodrigues FFL, Santos MAS, Teixeira CRS, Gonela JT, Zanetti ML. Relationship between knowledge, attitude, education and duration of disease in individuals with diabetes mellitus. *Acta Paul Enferm.* 2012;25(2):284-9. <http://dx.doi.org/10.1590/S0103-21002012000200020>
26. Kueh YC, Morris T, Borkoles E, Shee H. Modelling of diabetes knowledge, attitudes, self-management, and quality of life: a cross-sectional study with an Australian sample. *Health Qual Life Outcomes.* 2015;13:129. <https://doi.org/10.1186/s12955-015-0303-8>
27. Chrvla CA, Sherr D, Lipman RD. Diabetes self-management education for adults with type 2 diabetes mellitus: A systematic review of the effect on glycemic control. *Patient Educ Couns.* 2016;99(6):926-43. <https://doi.org/10.1016/j.pec.2015.11.003>
28. Nie R, Han Y, Xu J, Huang Q, Mao J. Illness perception, risk perception and health promotion self-care behaviors among Chinese patient with type 2 diabetes: A cross-sectional survey. *Appl Nurs Res.* 2018;39:89-96. <https://doi.org/10.1016/j.apnr.2017.11.010>
29. Lunes DH, Rocha CB, Borges NC, Marcon CO, Pereira VM, Carvalho LC. Self-care associated with home exercises in patients with type 2 diabetes mellitus. *PLoS One.* 2014;9(12):e114151. <https://doi.org/10.1371/journal.pone.0114151>
30. Flor LS, Campos MR. The prevalence of diabetes mellitus and its associated factors in the Brazilian adult population: evidence from a population-based survey. *Rev Bras Epidemiol.* 2017;20(1):16-29. <http://dx.doi.org/10.1590/1980-5497201700010002>
31. Thomas N, Alder E, Leese GP. Barriers to physical activity in patients with diabetes. *Postgrad Med J.* 2004;80(943):287-91. <https://doi.org/10.1136/pgmj.2003.010553>
32. Ferreira RW, Caputo EL, Häfele CA, Jerônimo JS, Florindo AA, Knuth AG, et al. Acesso aos programas públicos de atividade física no Brasil: Pesquisa Nacional de Saúde, 2013. *Cad Saude Publica.* 2019;35:e00008618. <https://doi.org/10.1590/0102-311x00008618>